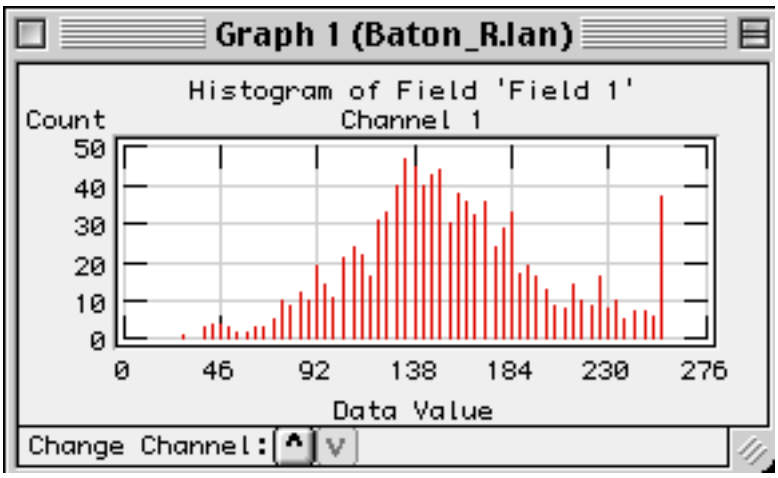
CREATING
HISTOGRAMS IN MULTISPEC



Larry Ryan
University of New Hampshire
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Viewing the Histogram of an Image or Area of Interest

Introduction: MultiSpec does not have the capability to directly produce a histogram of either an entire image or of a "Region of Interest" (ROI: An area selected by dragging a box.) With that said, however, there is a way to get histograms, and that is by doing part of the mechanics of a "Supervised Classification."

If you are unsure of just what a "histogram" is, see the Appendix to this exercise. If you are familiar with supervised classifications, or just wish to "get to it," skip the following paragraph and go right to the directions.

In a Supervised Classification, we select areas of an image (ROI's) and tell the computer what land cover they represent. These areas then become "Training Fields." If we can provide enough trainings fields, the system can then classify the image according to the data we have provided. In other words, *we* supervise the classification process. This is the opposite of the standard GLOBE protocol of "Unsupervised Classification," in which the computer system, by examining the spectral properties of pixels in an image, determines the classes into which the pixels are "clustered."

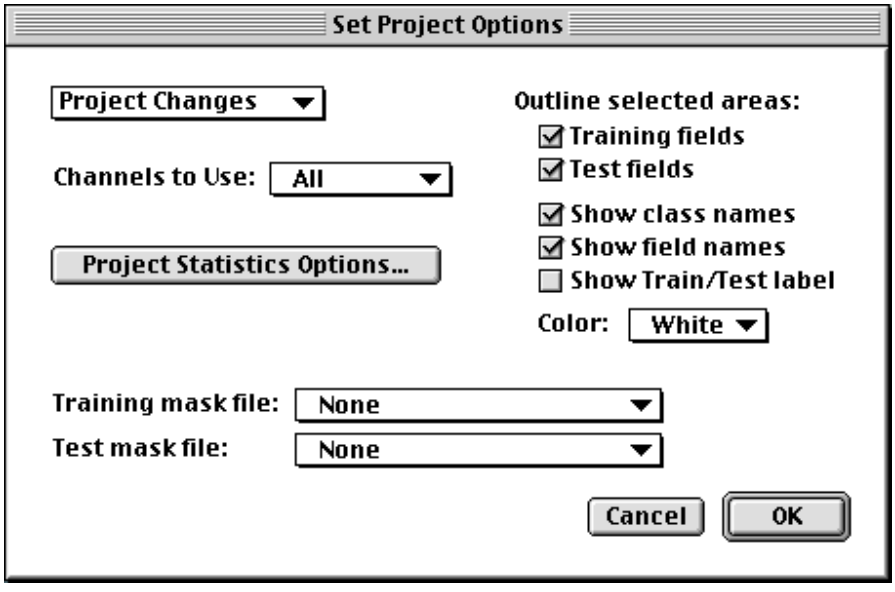
Directions:

Establishing Regions of Interest

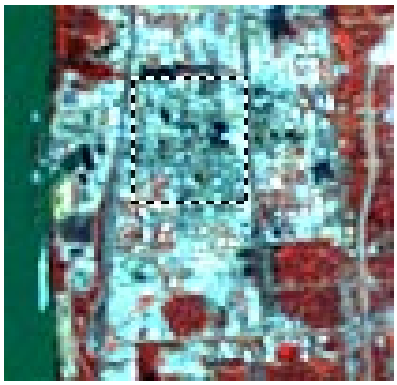
Note: The exact appearance of your screen and sequence of commands may vary slightly from those shown here depending on the version of MultiSpec you are using. The authors screen shots were taken from the April 2, 2000 release of MultiSpec for the Macintosh. The process is similar for all versions and platforms, but you may find some differences in keystrokes. If you experience any difficulties,, contact me at:

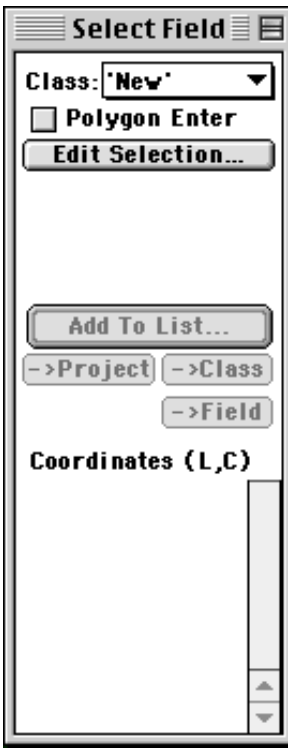
ryan@ekman.sr.unh.edu

- **Launch** MultiSpec
- **Open** your image
- From the **Project** menu, select **New Project**.
- In the **Set Program Options** window, shown below, **Click OK**.

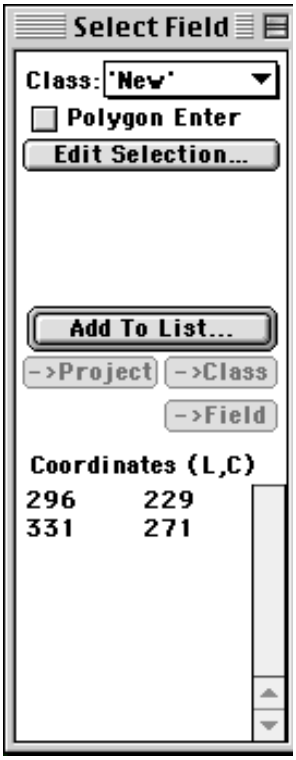


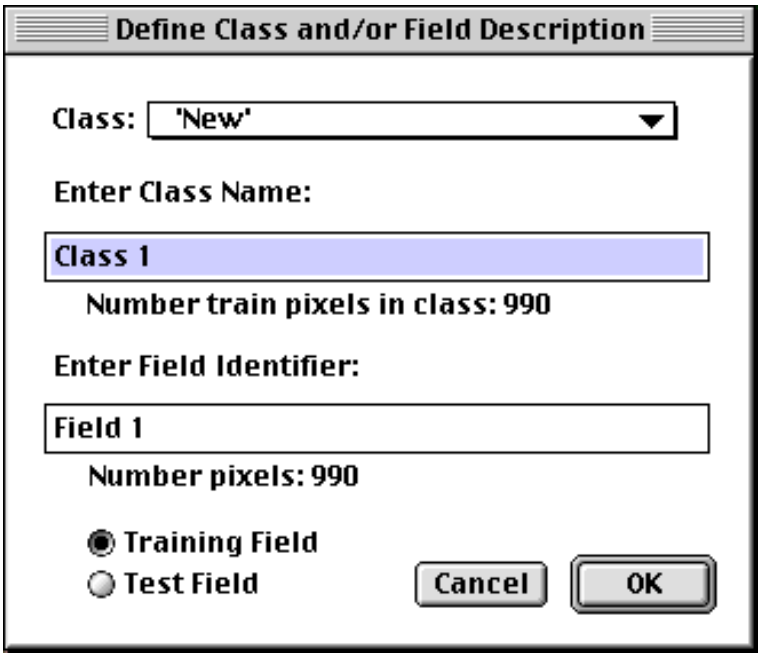
- The **Select Field** window opens, as shown to the right.
- Notice now that the title bar of your image window is "dimmed." This means that it is not "active." Click once in the image window to make it active.
- **Hold down** the mouse button (left button on PC's) and "**box**" the area whose histogram you wish to measure. The area you enclosed is called an "ROI," or "Region of Interest". The diagram below shows an ROI in an image of Baton Rouge, LA.





- Notice now that the "**Add to List**" button in the **Select Field** window is "active" (no longer dimmed) as shown to the right. **Click this button**.
- The **Define Class** window opens, shown below.

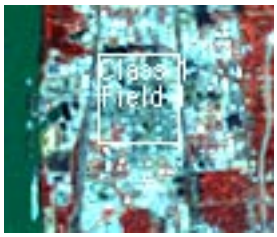




If we were doing an actual Supervised Classification, it is here that we would identify, with a Class name, the land cover type this ROI represents. For our work, however, this is not necessary.

- **Click OK** in this window.

- Our ROI has now become a "Training Field," and is labeled so in the image, as shown below.



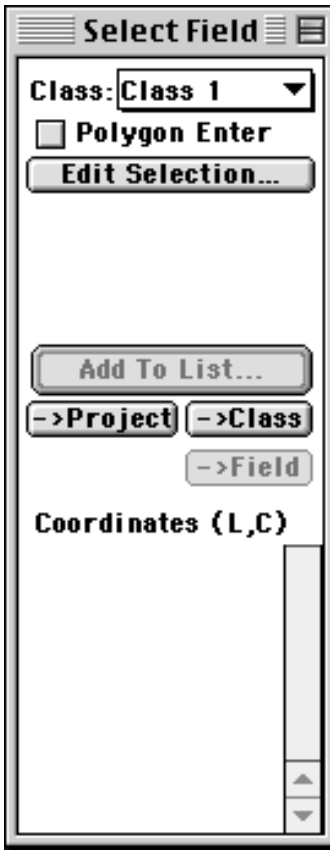
- At this point, you may define as many training fields are there are areas whose histograms you wish to view. They will be numbered in the order you define them.

Viewing the Histogram

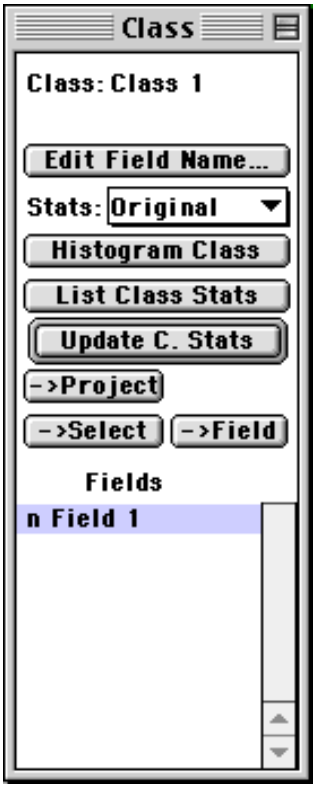
To view the histogram of your Training Field:

- **Click once** on the **Class button** in the **Select Field** window, as shown to the right.

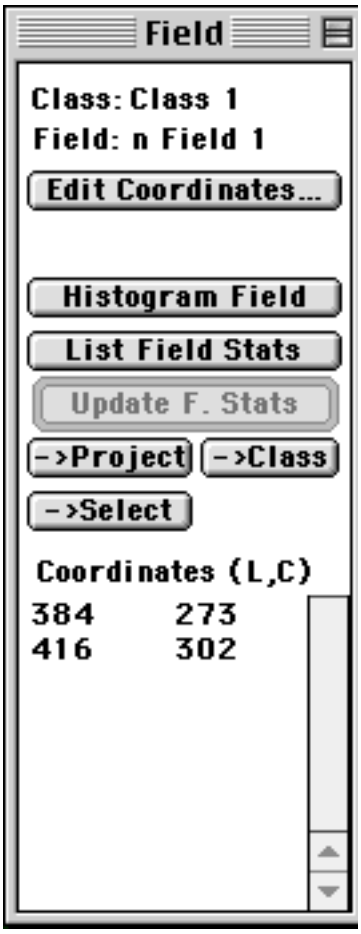
Note: If you have created multiple Training Fields (ROI's) they will be listed in this window, and you may select (click on) the one whose histogram you wish to view. Then proceed with the following steps.



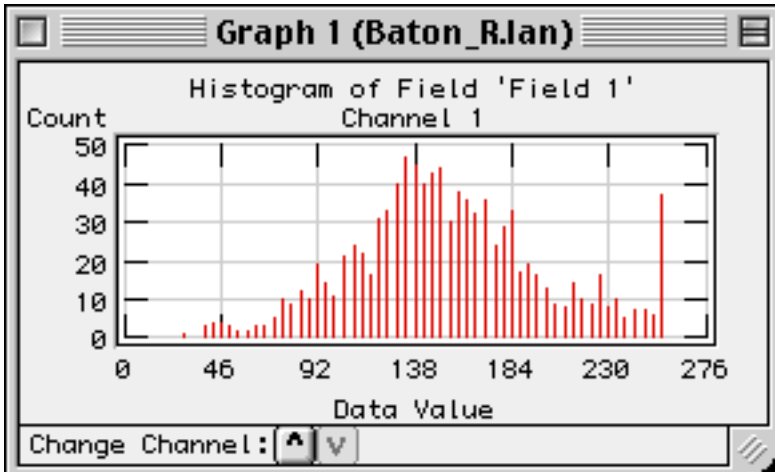
• Click once on the Field button in the Class window, shown to the right.



• The window changes to the **Field** window, as shown to the right.
• In this window, click once on the button **Histogram Field**. In the drag-down menu, select **Histogram**.
• If a window follows this action, click **OK**.



• After a little busy work, the histogram for that field opens in a separate window, as shown below.



• If the Histogram window is active, you may print the histogram directly, or you may copy the graph to paste it in other applications. Your ability to do these operations may depend on the version of MultiSpec you are using. If you do not have the latest version of the software, you may download it at no cost from the Purdue home page at:

http://dynamo.ecn.purdue.edu/~biehl/MultiSpec/

Note that the “M” and “S” in MultiSpec must be “upper case” letters.

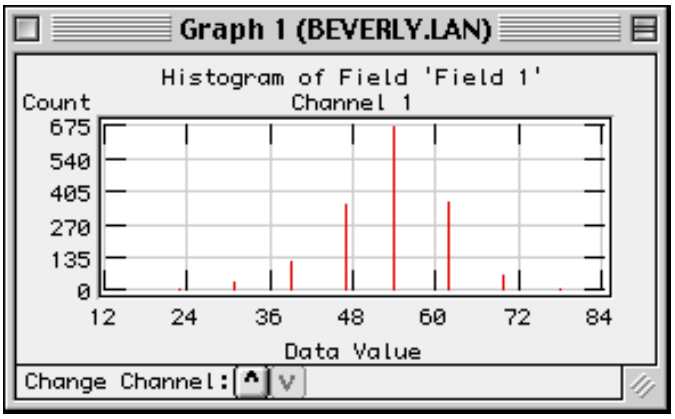
MultiSpectral Considerations:

LandSat Thematic Mapper (TM) images, as supplied to GLOBE schools, have five separate bands, or “channels,” of data, each one representing a different part of the electromagnetic spectrum. A histogram can only show one channel at a time, and the default is channel “1” which, in TM imagery, is the visible blue band. You may view the histograms of other channels in your training fields by clicking the “Change Channel” buttons in the bottom margin of the histogram. (See the Appendix for further details.)

Appendix

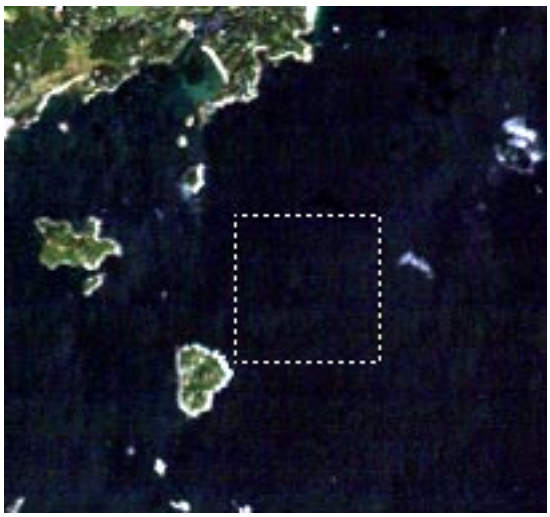
Part I: What is a histogram?

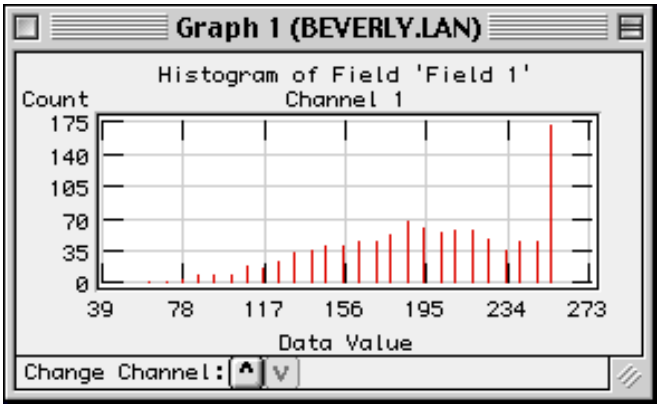
Satellite images, along with other digital images, are composed of arrays of "pixels." Each pixel has a numerical value that controls its brightness on your monitor. A histogram is a graph that shows us how many pixels there are at each value of brightness in an area of interest. It is usually done in the form of a bar graph.



As an example, examine the histogram to the right. The horizontal scale ("Data Value") shows the range of brightness values of all the pixels in a "region of interest" (ROI). Remember that Landsat pixels may have brightness values from 0 (black) to 255 (white). These values are all very low, indicating a dark area. The largest number of pixels (675) has a brightness value of about 55 (the tallest line). There are two other groups of pixels, at brightness values of 47 and 62, containing about 340 pixels each. There are a very few pixels with brightnesses of about 31, 38 and 70.

This area, therefore, should appear quite dark in our image, and it does not have much variation in the brightness of its pixels. This ROI is from the area shown to the right, (the boxed area) which is open ocean waters, which are quite dark in Landsat images and do not show much variation.

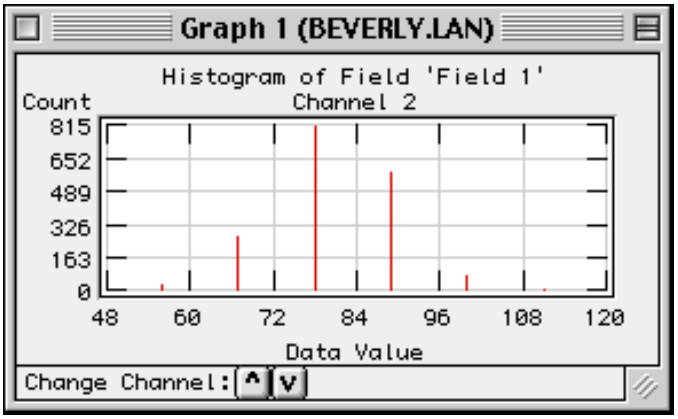


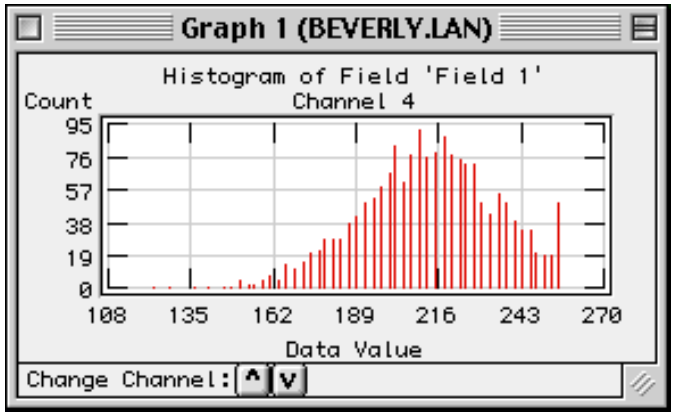


As a second example, examine the histogram shown to the right. In this one, there is a much greater range of brightness values for the pixels, shown by the Data Value scale running from about 60 to 255. This ROI contains pixels with a great variety of brightnesses. Also, there are significant numbers of pixels at many different brightnesses, as shown by the many different lines. We can also see that the most abundant pixel group in this ROI is very bright, about 175 pixels with a brightness of 255.

This ROI, shown to the right, is an urban area. Such areas are far more heterogeneous than ocean areas, and are characterized by lots of white, high reflectance surface features.

As a final example, examine the two histograms to the right. Both were taken from the same ROI, but represent different channels of the Landsat TM image. The first is channel 2, the visible green, and the second is channel 4, the near infrared. How do the two histograms differ? What do these differences tell us about this area?

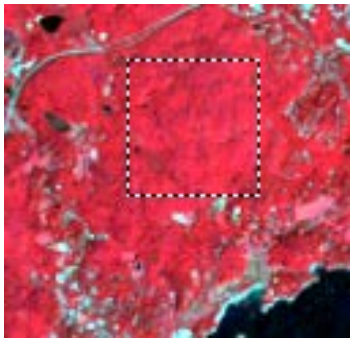




The area is much darker in the visible green, as shown by the low Data Values. The area is also fairly homogeneous, as shown by the few lines.

The histogram of channel 4 shows a much different picture. In this channel, the area is much brighter, as shown by the larger Data Values. The area is also much more heterogeneous, as shown by the larger number of lines.

The area represented here is shown below, both in visible and false-color infrared. It is a forested area. Remember that such areas are dark in the visible bands, and much brighter in the false-color IR image. The greater heterogeneity of such areas in the near-infrared is what allows us to better discriminate vegetation types in this channel combination.

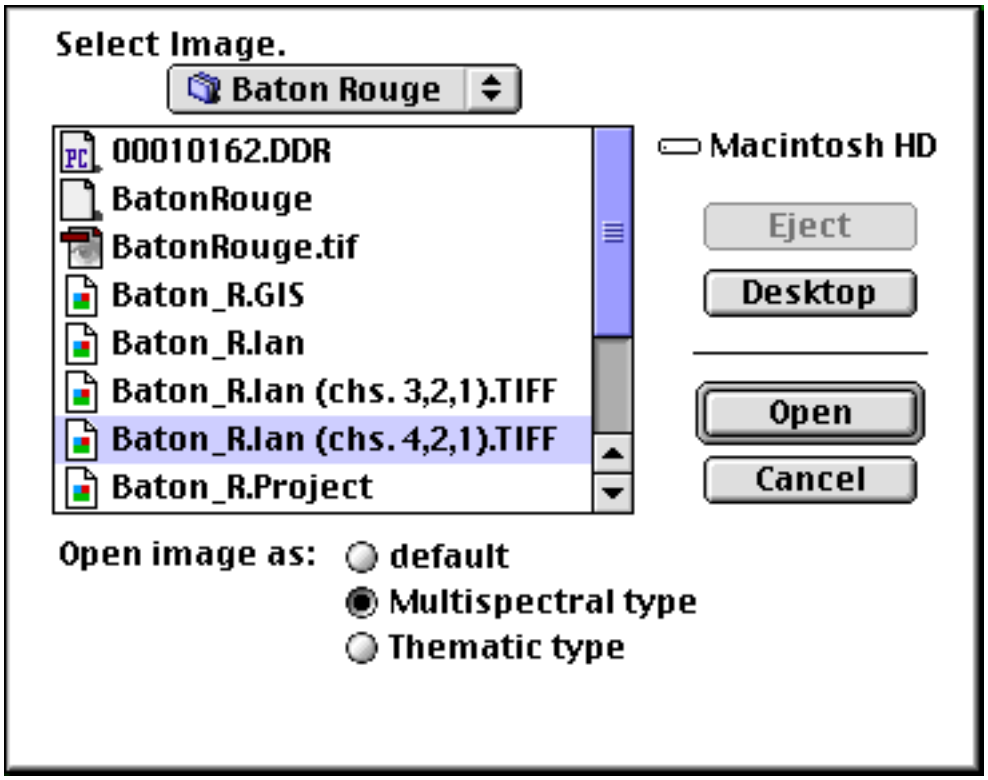


Histogramming Other Images

This histogram feature can be made to apply to clustered (.clu) and Tiff (.tif) images from MultiSpec, and some .tif files produced by other software. Clustered images will appear only as single channel greyscale images, so some of the value of histogramming is lost. Tiff files produce good histograms, however.

The "secret" to this process is to force MultiSpec to view the image as multispectral. To do this:

- **Launch** MultiSpec.
- Select **Open Imag**e from the **File** menu.
- In the **Select Image** dialog box, as shown below, select the **Multispectral type** option, , as shown below.



- Now proceed with the procedure outlined in this tutorial.

Histogramming an entire image:

Should you want a histogram for an entire image, you can do this by dragging a training field across the entire image area, and treating it as any other training field. You may also define smaller training fields within this large one.

